

Amendments to Specification

Please amend the specification section from page 2, line 26 through page 5, line 10 as follows:

More specifically, our invention is a linear optical signal sampler apparatus for measuring temporal samples of a data modulated optical signal (~~DOS~~ MOS) 101, the linear optical signal sampler apparatus comprising

a pulsed optical signal (POS) 102 having the same polarization as the MOS ~~DOS~~ and operable at a pulse rate equal to a fraction of the data modulation rate of the MOS ~~DOS~~;

a 90⁰ hybrid having a first input for receiving the MOS ~~DOS~~ and a second input for receiving the POS, the hybrid combining the MOS ~~DOS~~ and POS to produce temporal quadrature samples S_A and S_B of the interference of the electrical fields of the MOS ~~DOS~~ with the POS, the optical signals producing the S_A quadrature samples being outputted at a first and second outputs, and the optical signals producing the S_B quadrature samples being outputted at a third and fourth outputs;

two balanced photodetectors (BDA,BDB) 120, 121 operable at the pulse rate of the POS, coupled to the first, second, third, and fourth outputs for detecting and generating analog electrical signal representations of the S_A and S_B quadrature samples;

a sampling analog/digital (A/D) converter apparatus 130 for sampling and generating digital representations of the real and imaginary components of the S_A and S_B quadratures samples, the sampling A/D detector apparatus being synchronized to the pulses of the POS ~~SOS~~; and

a processor for compensating for optical and electrical signal handling imperfections in the hybrid, balanced detectors, and A/D converters and for measuring temporal signal samples using quadratures samples S_A and S_B and then generating a demodulated sampled data pulse from the quadratures samples S_A and S_B .

According to another feature of our invention, we describe a method of operating an optical signal sampler apparatus for measuring temporal samples of a data modulated optical signal (MOS DOS) 101, comprising the steps of:

- (1) receiving a data-modulated optical signal (MOS DOS);
- (2) receiving a pulsed optical signal (POS) at a pulse rate equal to a fraction of the data modulation rate of the MOS DOS;
- (3) producing a S_A and a S_B quadratures samples of the interference of the electrical fields of the MOS DOS with the POS;
- (4) detecting and generating digital representations of the S_A and S_B quadratures samples;
- (5) compensating for signal handling imperfections in the apparatus used to perform steps (3) and (4);
- (6) measuring temporal signal samples by generating a demodulated sampled pulse from the quadratures samples S_A and S_B .

Another aspect of our invention is directed to an optical receiver for demodulating the data from a data modulated optical signal source (MOS DOS) 101 received over an optical facility, the optical receiver comprising

a pulsed optical signal source (POS) 102, having the same polarization as the MOS ~~DOS~~, operable at a pulse rate equal to the data modulation rate of the MOS ~~DOS~~;

a 90° hybrid having a first input for receiving the MOS ~~DOS~~ and a second input for receiving the POS, the hybrid combining the MOS ~~DOS~~ and POS to produce quadratures samples S_A and S_B of the interference of the electrical fields of the MOS ~~DOS~~ with the POS, the signals producing the S_A quadrature samples being outputted at a first and second outputs, and the optical signals producing the S_B quadrature samples being outputted at a third and fourth outputs;

a first balanced photodetector (BDA) 120, operable at the data modulation rate of the MOS ~~DOS~~, coupled to the first and second outputs for detecting and generating analog electrical signal representations of the S_A quadrature samples;

a second balanced detector BDB 121, operable at the data modulation rate of the MOS ~~DOS~~, coupled to the third and fourth outputs for detecting and generating analog electrical signal representations of the S_B quadrature samples;

a sampling analog/digital (A/D) converter apparatus 130 for sampling and generating digital representations of the S_A and S_B quadratures samples, the sampling A/D detector apparatus being synchronized to the pulses of the POS ~~SOS~~; and

a processor apparatus for processing the two quadratures samples S_A and S_B and for generating therefrom a demodulated sample data output.

Please amend the specification section from page 15, line 9 through page 16, line 15 as follows:

Shown in Fig. 11 is an implementation of our invention as an optical receiver for demodulating a data modulated optical signal (DOS_MOS) 1101 received over an optical facility. As shown MOS_DOS 1101 is coupled to a first input port of a 90° optical hybrid 110. A pulse optical source 1102 (pulsed laser signal) having the same data (or pulse) rate and polarization as MOS_DOS 1101, connects to a second input port of 90° optical hybrid 110. As previously discussed with reference to Fig. 1, the optical hybrid 110 may be implemented using one hybrid (see Figs. 2, 6, 9, and 10) or using two hybrids (see Figs. 7 and 8). Depending on the configuration, two balanced detectors (e.g., BDA, BDB of Fig. 2) or four balanced detectors (e.g., BDA, BDB and BDC, BDD of Fig. 7) are used in balance detector unit 1120. The A/D unit 1130 is selected to be compatible with balanced detector unit 1120, so as to be able to process the outputs from the one or two set of balanced detectors. For convenience, the receiver of Fig. 11 is assumed to use one hybrid in hybrid unit 110, one set of balanced detectors in balanced detector unit 1120, and an compatible A/D unit 1130.

A portion of the pulse optical source 1102 is coupled, via coupler 103, to provide a trigger signal to synchronize the operation of analog/digital (A/D) circuit 1103. In an alternate arrangement (shown in dotted-lines in Fig. 11), a clock signal 1151 (for example, in the RF domain) from the processor 1140 is used to set the sampling rate of pulsed source 1102 and the sampling rate of A/D circuit 1130.

The 90° optical hybrid 110 produces an interference of the electric field of MOS_DOS 1101 with the electric field of pulsed laser signal 1102 resulting in the generation of two quadratures interference samples S_A and S_B . The two quadratures interference samples S_A and S_B are measured with two high speed balanced photodetectors (BDA and BDB) 1102, which operate at the data rate of

~~MOS DOS~~ 1101. Illustratively, the two high speed balanced photodetectors 1102 may be implemented using silicon or InGaAs. The outputs of BDA and BDB, 1102, are sampled by the two ports of an A/D board 1103. The A/D circuit 1103 is arranged to operate at the data rate of ~~MOS DOS~~ 1001, so as to be able to generate digital samples of the quadratures interference samples S_A and S_B . Illustratively, the A/D circuit 1103 may contain sample-and-hold circuits that are commonly used in telecommunication systems. In the same manner as discussed with reference to Fig. 1, the processor 1104 is arranged to calculate a demodulated sample data signal 1105 having an power level equal to the sum $S_A^2 + S_B^2$. Since the pulse optical source 1102, BDA and BDB, 1102, A/D board 1103, and processor 1104 all operate at input data modulated optical signal (~~MOS DOS~~) 1101 rate, the demodulated output signal 1105 is at the data rate of ~~MOS DOS~~ 1101. The data transmission rate of the receiver of Fig. 11 is limited by the bandwidth of the two high speed balanced photodetectors (BDA and BDB) 1102.